Available online at http://www.ijasrd.org/in

International Journal of Advanced Scientific Research & Development

Vol. 01, Iss. 01, Ver. I, Oct – Dec' 2014, pp. 25 – 32

e-ISSN: 2395-6089
p-ISSN: 2394-8906

A Review Based Study of Classification of X-Ray Images Using Content Based Image Retrieval (CBIR)

E. SARANYA

Assistant Professor, Department of CSE, Sir Issac Newton College of Engineering and Technology, Nagapattinam, India.

S. PRAVEENKUMAR

Assistant Professor, Department of CSE, EGS Pillay Engineering College, Nagapattinam, India.

N. S. USHA

Assistant Professor, Department of CSE, Sir Issac Newton College of Engineering and Technology, Nagapattinam, India.

ARTICLE INFO

Article History:

Received: 30 Nov 2014;
Received in revised form:
08 Dec 2014;
Accepted: 11 Dec 2014;
Published online: 30 Dec 2014.

Key words:

Content based image retrieval,
CBIR,
GLCM and SVM,
Image Retrieval,
Invariant Moments,
X-ray.

ABSTRACT

Content-based image retrieval (CBIR) is an application of computer vision techniques for the image retrieval problem, specifically the search for specific medical images in large databases. In this work the X-ray images are taken from the medical database includes skull, spine, chest and leg x-ray images. The X-ray images are taken in the .jpeg format. In this project, a complete solution for search and retrieval of rich multimedia content over large databases is presented. This work initially performs preprocessing to reduce the distortions for further processing. After the segmentation process the Support Vector Machine (SVM) is used for classification purpose of X-ray images. The framework proposed in this work involves the feature vector (FV) creation and similar image retrieval (IR). Here the Invariant Moments (IMs) are used to extract the shape features and GLCM is used to extract the texture features for. These extracted features are used for the construction of feature vector. Based on the feature vector the relevant images are extracted by giving the query image. Moreover, CBIR is an effective technique, which is appropriate for large-scale indexing, is adopted, extended and integrated to the proposed framework so as to achieve optimized search and retrieval of rich media content even from large database.

Copyright © 2014 IJASRD. This is an open access article distributed under the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Saranya, E., Praveenkumar, S., & Usha, N. S., (2014). "A Review Based Study of Classification of X-Ray Images Using Content Based Image Retrieval (CBIR)". *International Journal of Advanced Scientific Research & Development (IJASRD), 01* (01/I), pp. 25 – 32.

INTRODUCTION

A medical image plays a central role in patient diagnosis, therapy, surgical planning, medical reference, and training. With the recent boom in the availability of filmless radiology equipment, the management of digital medical images is receiving more and more attention. Picture Archiving and Communication Systems (PACS) have been successfully introduced in many hospitals and specialized clinics, providing quick access to screening exams and integrating the actors involved in the enterprise's workflow. The radiological databases originally built for storing digital images have evolved from simple storage servers of past exams, kept for legal reasons, to active and easily accessible repositories for research and decision support.

The two approaches commonly used for image retrieval are referred to simply as global-based image searches and region (or sub-image)-based image searches. An important distinction between these approaches is that global-based methods enables the whole image matching and consider the relevant image, while region-based methods focus primarily on specifying a region and on retrieving a large number of images with similar objects. Both methods are useful for image retrieval, but are best suited to queries of different types. Searching by global distinction is the preferred approach in cases where the user provides a whole image for query (i.e. query-by-example), where queries take the form of “show me more relevant images that look like this query image”.

Current work in medical image retrieval provides an effective result for medical diagnosis with the increased performance of CBIR to radiology practice in future. Feature database creation has often been treated as a preprocessing step for removing the unwanted distortions of X-ray images in large databases. The feature extraction step extracts both the shape and texture features by using Zernike moments (ZM) and GLCM respectively. The classification step aims to classify the X-ray images with the help of SVM classifier. Finally, the set of classified images were stored into the database, which is called as feature database.

In this work an effort has been made to create the feature database. After extracting the features, the features are constructed as a vector called feature vector. These feature vectors will be useful (are used) to classify the images based on SVM classifier namely skull, spine, chest and leg images which will be used for creating the feature database.

The x-ray images used for this work are collected from the hospitals and the radiologists. This collection of X-ray images includes skull, spine, chest, leg and hand X-ray images. The X-ray images are taken in the form of .jpeg, .bmp, .mpeg, etc. in our work the .jpeg format images are taken. The imagery represents different ages, genders, view positions and pathologies. Therefore, image quality varies significantly. All images were downscaled to fit into a 512 × 512 bounding box for maintaining the original aspect ratio.

1.1 Literature Survey

Literature survey is the most important step in software development process. Before developing the tool, it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration is taken into account for developing the proposed system.

In paper[1], B. Ramamurthy et all presents that for Content Based Image Retrieval using Invariant Moments, GLCM and Gray scale for Medical Images, with the usage of the Fuzzy C-Means Classification Algorithm and Euclidean Distance Methods. In[2], Kashif Iqbal et all proposed that for Content Based Image Retrieval approach for Biometric security using colour, and shape features controlled by fuzzy heuristics by using Colour Histogram, Texture Analysis and Moment Invariant Algorithms.

In[3], Chandan Singh et all discussed that for an Effective Image Retrieval using the fusion of global and local transforms based on Angular Radial Transform (ART) and Polar Hough Transform (PHT) techniques. In paper[4], Bikesh kr. Singh et all presents that for The Content Based Retrieval of X-ray images using fusion of Spectral Texture and Shape Descriptors with the efficiency rate of 94.28%.

In[5], Hai Jin proposed et all that for Content and Semantic Context Based Image Retrieval for Medical Image Grid based on CGSP (China Grid Supporting Platform) technique. In[6], Thomas M. Lehman et all proposed a novel framework for Content-Based Image Retrieval in Medical Applications for Picture Archiving and Communication Systems (PACS) which provides the suitable quality for medical diagnosis.

In[7], Soumya Dutta et all discussed the work that for A Change Detection Algorithm for Medical Cell Images by using Adaptive Median Filter, Standard Deviation calculation for discontinuity measurement Threshold technique and Change Detection methods. In[8], Hamed shahbazi et all proposed a framework that for Content Based Multispectral Image Retrieval using PCA (Principal Component Analysis) with the combination of Local Histogram and GLCM techniques.

In[9], Ch. Kavitha et all presents a work for Image Retrieval Based on Combined features of Image Sub-blocks by using Radiance Histogram(RH) and Multispectral Co-Occurrence Matrix (MCM) with Precision=79.5% and Recall = 82.5%. In Paper[10], Vimina E R et all proposed a novel work for an Image Retrieval System using Local and Global properties of Image Regions with Relevance Feedback by using HSV (Hue Saturation Value) histograms for colour space, GLCM for Texture feature and Edge Histogram Descriptors (EHD) for Shape features.

PREVIOUS WORK

The existing work in the CBIR using Query Based Image Retrieval (QBIR) in medical data analysis. This may give the results related to that query which was given as the input. It takes more time to retrieve the data and retrieves lot of images related to the given input. That causes the confusion and less flexible to analyze and retrieve the needed data. This work use textual queries to retrieve the results. Its performance is poor and throughput is not efficient.

PROPOSED WORK

The main aim of CBIR is to build a single universal CBMIR system using low level features. That feature helps the physician to construct or create the feature database for the X-ray images to the corresponding medical X-ray images. This gives the effective results of the medical image processing in large database. The block diagram of general CBIR system is shown in fig. 1.

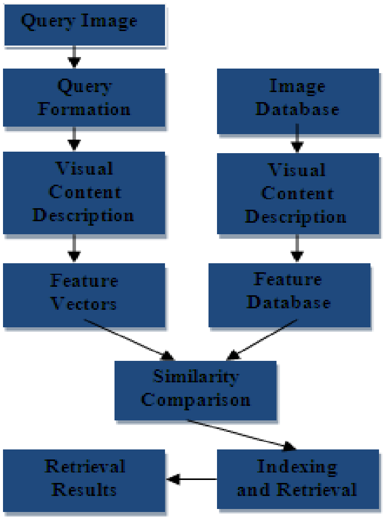


Fig – 1: General CBIR System

The below fig. 2 that will show the proposed system architecture

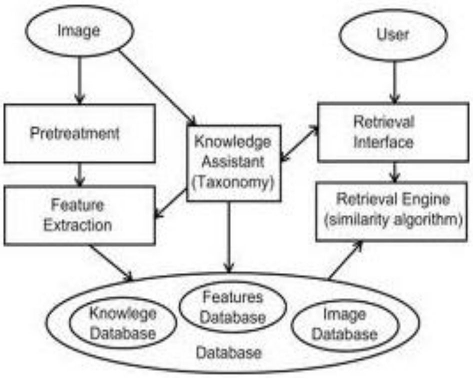


Fig – 2: Proposed CBIR system architecture

3.1 Pre-processing:

Range filtering and histogram equalization[3] is applied to the X-ray images to reducing the distortions and enhance the image. Then the images are resized uniformly and the resized images are segmented to avoid the unnecessary computations and misclassifications. After segmentation the images are filtered to reduce the noise by using median and standard filter. Then the images are ready for feature extraction.

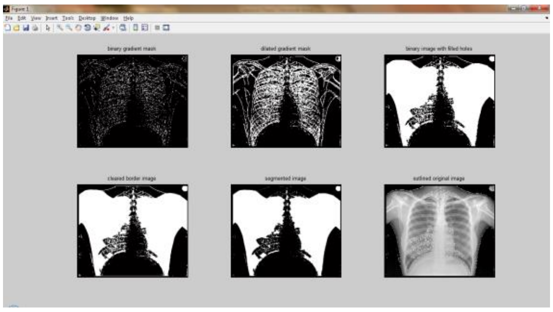


Fig – 3: Preprocessed Image

3.2 Feature Extraction:

3.2.1 Shape Feature Extraction using ZM:

Shape normally implies a vital medical property. Masses with similar shapes may belong to the same lesion category. Zernike moments have been reported to be a good descriptor for shape description. Therefore, this study uses the Zernike moments for describing mammographic masses because of the methods' properties.

$$\varphi 1 = \mu 20 + \mu 02$$

$$\varphi 2 = (\mu 20 + \mu 02)^2 + (4\mu 11)^2$$

$$\varphi 3 = (\mu 30 + 3\mu 12)^2 + (3\mu 21 - \mu 03)^2$$

$$\varphi 4 = (\mu 30 + \mu 12)^2 + (\mu 21 - \mu 03)^2$$

Even if the object is not segmented perfectly, the Zernike moments will not result in an extreme variation. This makes Zernike moments suitable for representing masses with obscure boundaries.

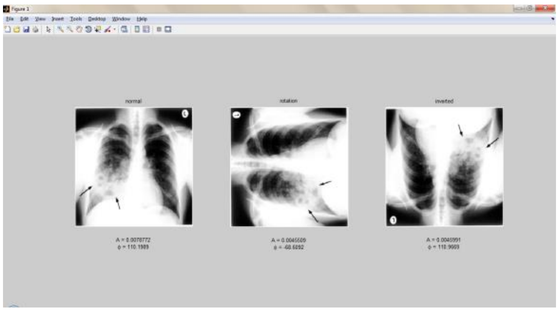


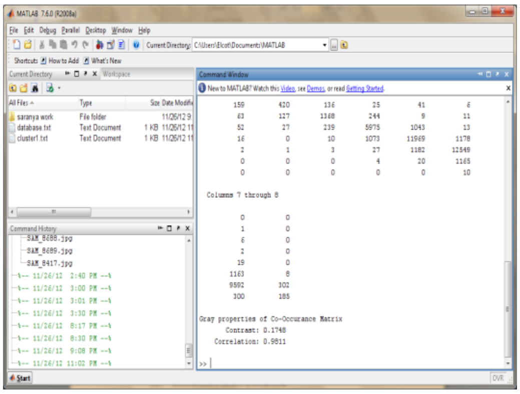
Fig – 4: Shape Fature extraction

3.2.2 Texture Feature Extraction using GLCM:

Texture is one of the most important defining characteristics of an image. It is characterized by the spatial distribution of gray levels in a neighborhood. There are different types of texture feature extraction methods like statistical, geometrical, and model-based and signal processing features. In our work we are using the Gray Level Co-occurrence Matrix (GLCM) for extracting the texture features.

The following are some texture properties of X-Ray images.

1. Energy=$\sum_i \sum_j pd\,2(i,j)$
2. Entropy=$\sum_i \sum_j pd2(i,j)logpd(i,j)$
3. Correlation=$\sum_i \sum_j (i-\mu)(j-\mu)pd(i,j)/\sigma x\sigma y$
4. Homogeneity =$\sum_i \sum_j pd\,(i,j)/1+(i-j)2$


MATLAB 7.6.0 (R2008a)
File Edit Debug Parallel Desktop Window Help
Current Directory: C:\Users\Elcot\Documents\MATLAB
Shortcuts How to Add What's New
Current Directory
Workspace
Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.
Command History
Start
OVR

All Files	Type	Size	Date Modified
saranya work	File folder		11/26/12 9
database.txt	Text Document	1 KB	11/26/12 11
cluster1.txt	Text Document	1 KB	11/26/12 11

```
  SAM_8688.jpg
  SAM_8689.jpg
  SAM_8417.jpg
%-- 11/26/12  2:40 PM --%
%-- 11/26/12  3:00 PM --%
%-- 11/26/12  3:01 PM --%
%-- 11/26/12  3:30 PM --%
%-- 11/26/12  8:17 PM --%
%-- 11/26/12  8:30 PM --%
%-- 11/26/12  9:08 PM --%
%-- 11/26/12 11:02 PM --%
```

```
       159         420         136          25          41           6
        63         127        1368         244           9          11
        52          27         239        5975        1043          13
        16           0          10        1073       11969        1178
         2           1           3          27        1182       12549
         0           0           0           4          20        1165
         0           0           0           0           0          10

  Columns 7 through 8

         0           0
         1           0
         6           0
         2           0
        19           0
      1163           8
      9592         302
       300         185

Gray properties of Co-Occurance Matrix
      Contrast: 0.1748
    Correlation: 0.9811

>>
```

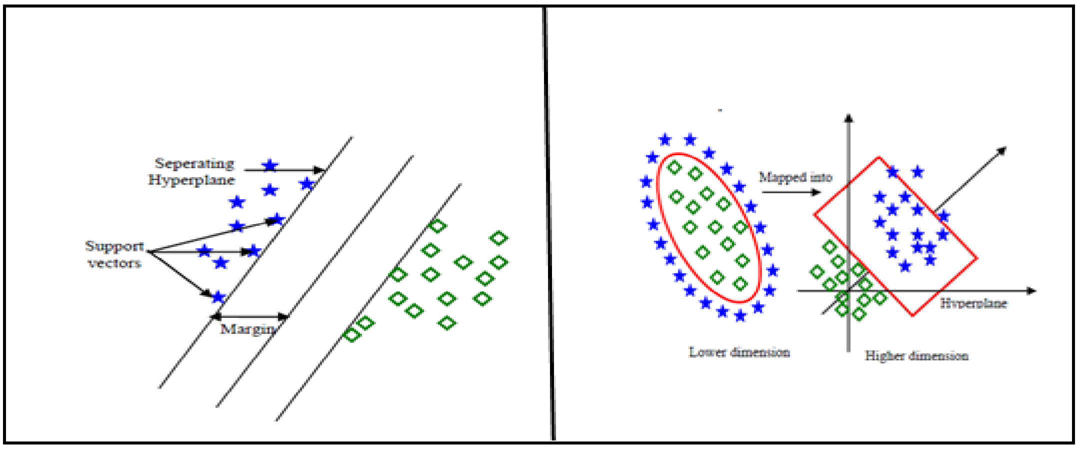
Fig – 5: Txture Feature Extraction

These extracted features are stored into the newly created database.

3.3 Classification Using SVM:

Classification is a technique to detect the dissimilar texture regions of the image based on its features. It can be used to classify the feature sets of the image that characterized as different regions. In this study, Support Vector Machine (SVM) algorithm is used for classifying the texture regions of the image.

SVM is a classifier used to classify the images, which was developed by Vapnik. So that different regions of the texture image have been identified in order to increase the performance of the retrieval by comparing the classified texture image with user's query images.



a. Maximum margin hyper lane **b. Simple view of SVM**

Fig – 6: SVM Model

Classification is a method of identification of the different texture regions based on the corresponding features.

EXPERIMENTAL RESULTS AND DISCUSSION

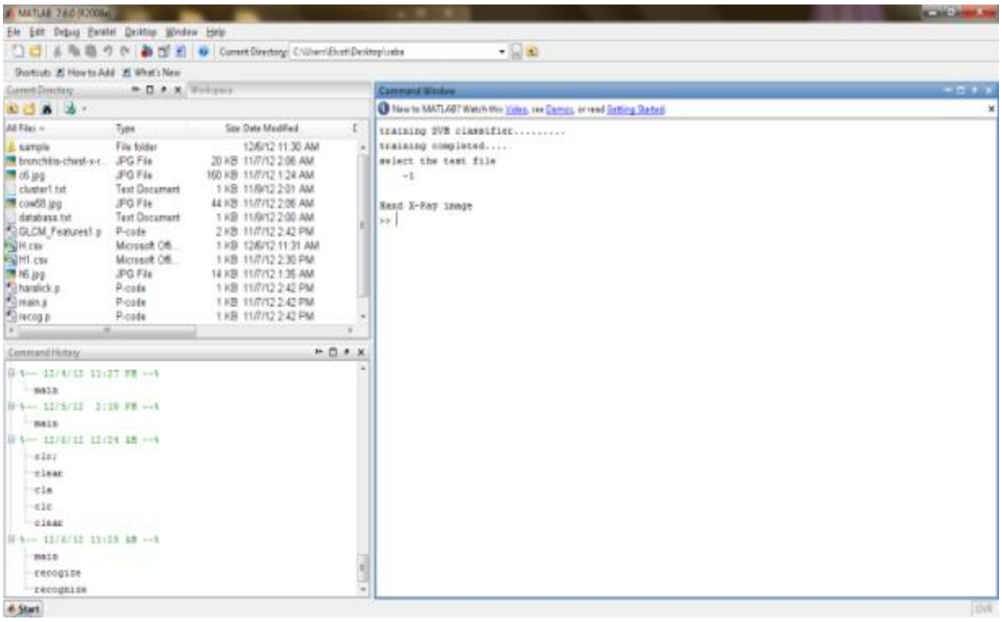
First the X-ray images are prepossessed and segmented using range filter and MPEG-4 Fourier descriptor. Then the shape and texture features are extracted using ZM and GLCM and the X-ray images are classified using SVM. Based on the classification results the images are stored into the database called feature database. Hence the feature database is created.

Table 1 – GLCM Features of X-Ray

Image	Energy	Homogeneity	Entropy	Entropy	Correlation
C1	0.1010	0.9497	9.3181	-0.7921	0.9695
C2	0.1446	0.9301	8.2297	-0.7507	0.9707
C3	0.1094	0.9496	10.161	-0.791	0.9695
C4	0.1562	0.9277	11.036	-0.7273	0.9600
C5	0.0786	0.9627	8.122	-0.8323	0.9767
L1	0.2492	0.9158	5.1174	-0.7020	0.9460
L2	0.2267	0.9205	6.3116	-0.7191	0.9583

L3	0.2637	0.9369	3.5917	-0.6391	0.8218
L4	0.0831	0.9630	5.6692	-0.7849	0.9200
L5	0.1670	0.9289	5.0841	-0.7174	0.9416

The fig. 7 illustrates the classification of X-Ray Image and its results.



```
training SVM classifier.........
training completed....
select the test file
     -1

Read X-Ray image
>> 
```

Fig – 7: Image Classification using SVM

CONCLUSION AND FUTURE WORK

Content-based visual information retrieval definitely has a large potential in the medical domain. However, its acceptance by the physicians will depend mainly on their efficacy and efficiency. This work proposed a MPEG-4 descriptor for shape features and GLCM for texture features to improve both efficacy and efficiency in content-based image retrieval (CBIR) systems. SVM classifier is used for classifying the x-ray images based on their features. It employs a wrapper strategy that searches for the best reduced feature set, while improving (or at least preserving) the quality of the results of similarity searches. This work creates the feature database (FD) by using the features extracted from the x-ray images. Our future work will be on the similar image retrieval (IR) by using the CBIR techniques by combing both the features of our query image and the extracted medical x-ray images. In that the Query Engine that matches (index) both query and extracted images. Finally, it will produce the result and display the images which is similar to our given query image. This work shows that the efficient feature database creation for content based image retrieval.

REFERENCES

[1] B. Ramamurthy, K. R. Chandran, S. Aishwarya, and P. Janaranjani, “CBMIR: Content Based Image Retrieval using Invariant Moments, GLCM and Grayscale Resolution for Medical Images”, *European Journal of Scientific Research, 59* (4), (2011), pp. 460 – 471.

[2] Kashif Iqbal, Michael O. Odetayo, and Anne James, "Content-based image retrieval approach for biometric security using colour, texture, shape features controlled by fuzzy heuristics", *Journal of Computer and System Sciences 78,* (2012), 1258 – 1277.

[3] Chandan Singh, and Pooja, "An effective image retrieval using the fusion of global and local transforms based features", *Optics & Laser Technology, 44*, (2012). Pp. 2249 – 2259.

[4] Bikesh Kr. Singh, G. R Sinha, Bidyut Mazumar, and Md. Imrose Khan, *"Content Based Retrieval of X-ray Images Using Fusion of Spectral Texture and Shape Descriptors",* 2010 International Conference on Advances in Recent Technologies in Communication and Computing 9789-0-7695-4201-0/10DOI 10.1.1109/ARTCom.2010.51.

[5] Hai Jin, Aobing Sun, Ran Zheng, Ruhan He, Qin Zhang, Yingjie Shi, and Wen Yang, *"Content and Semantic Context Based Image Retrieval for Medical Image Grid"*, National High Technology Research and Development Program of China, No.2006AA02Z347 and No.2006AA01A115.

[6] Thomas M. Lehman, Mark O. Guid, Christian Thies, Benedikt Fischer, Daniel Keysers, Michael Kohnen, Henning Schubert, and Berthold B. Wein, *"Content-based image retrieval in medical applications for picture archiving and communication systems"*, Department of Medical Informatics, Pauwelsstr. 30, D – 52057 Aachen, Germany.

[7] Soumya Dutta, Dr. Madhurima Chattopadhyay, "A Change Detection Algorithm for Medical Cell Images", *International Journal on Computer Science and Engineering (IJCSE),* Feb 2011.

[8] Hamed Shahbazi, Mohsen Soryani, and Peyman Kabiri, *"Content Based Multispectral Image Retrieval Using Principal Component Analysis"*, CVIR`08, July, pp. 7 – 9, 2008, Copyright 2008, ACM 978-1-60558-070-8/08/07.

[9] Ch. Kavitha, Dr. B. Prabhakara Roa, and Dr. A. Govandhan, "Image Retrieval based on combined features of image sub-blocks", *International Journal on Computer Science and Engineering (IJCSE), 3* (4), Apr 2011.

[10] Vimina E R, and Poulose Jacob K, *"Image Retrieval using Local and Global Properties of Image Regions with Relevance Feedback"*, ICACCI`12, August 3 – 5, 2012, ACM978-1-4503-1196-0/12/08.